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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/565,916	01/25/2006	Tammy Cheng	DC5157 PCT1	9371
137 7590 05/24/2010 DOW CORNING CORPORATION CO1232 2200 W. SALZBURG ROAD P.O. BOX 994 MIDLAND, MI 48686-0994				
EXAMINER				
SMOOT, STEPHEN W				
ART UNIT		PAPER NUMBER		
2813				
NOTIFICATION DATE		DELIVERY MODE		
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

patents.admin@dowcorning.com

Office Action Summary

Application No.

10/565,916

Applicant(s)

CHENG ET AL.

Examiner

Stephen W. Smoot

Art Unit

2813

Period for Reply -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 April 2010.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2,4,7-12 and 15-24 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2,4,7-12,15,16 and 18-24 is/are rejected.
- 7) ☒ Claim(s) 17 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 25 January 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

This Office action is in response to applicant's RCE filed on 28 April 2010.

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's amendment filed on 28 April 2010 has been entered.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

3. Claims 15, 22-24 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 24 recites the limitation "the product of step f)" in line 2.

There is insufficient antecedent basis for this limitation in claim 24 because it directly depends on claim 15, which does not include a step f).

Claim 15 recites the limitation "the silicone composition" in line 17.

There is insufficient antecedent basis for this limitation in claim 15.

Claims 22-24 are rejected under 35 U.S.C. 112, second paragraph, because they depend on claim 15.

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 7-12, 15-16 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano et al. (US 2002/0153618 A1) in view of Bottini (US 3,808,673).

Referring to Figs. 1-10 and paragraphs [0051] to [0071], Hirano et al. disclose a semiconductor device that includes a semiconductor chip (7A) mounted onto a surface of a substrate (1) using an adhesive (9), bond wires (10) to electrically connect the chip (7A) to the substrate (1), a silicone-containing overmold resin (11) to seal the chip (7A) (see paragraph [0065]), and solder balls (12) on an opposite surface of the substrate

(1). Referring to Figs. 11-13 and paragraphs [0072] to [0079], Hirano et al. further disclose that the semiconductor device can be formed by using adhesive (9) to mount the chip (7A) to a plastic film (20), connecting bond wires (10) between the chip (7A) and the plastic film (20), placing this assembly in a mold (30) to apply the silicone-containing overmold resin (11) by injection molding, applying solder balls (12) to the opposite surface, and cutting the plastic film into a substrate (1). These are limitations as set forth in claims 7-8, 15-16 of the applicant's invention.

However, Hirano et al. lack specific details regarding their injection molding process including the clamping force between 1 to 80 tons (a limitation of claims 7, 15-16) or, more specifically, between 1 to 27 tons (the limitation of claim 9), an injection pressure between 0.3 to 7 MPa (a limitation of claims 7, 15-16), heating the mold cavity (a limitation of claims 7, 15-16), and curing the die attach adhesive (a limitation of claim 15). Further, Hirano et al. lack a silicone viscosity of 80 to 3000 Poise and a cured product of the silicone composition having a modulus of 100 to 1000 MPa, which are limitations of independent claims 7, 15-16.

Bottini teaches that a semiconductor device can be packaged by injection molding and that the mold material can be silicone resin that can be cured for 120 to 150 seconds using a mold temperature of 190 degrees C, using a pressure of 600 psig (i.e about 4 MPa), and using a clamping force of 15 tons (see column 4, lines 25-43).

Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to combine the teachings of Hirano et al. and Bottini in order to use the molding parameters, as taught by Bottini, for sealing the package of

Hirano et al. by injection molding, because Bottini shows that these are known parameters for molding silicone resin. Regarding the silicone viscosity and the modulus of the cured silicone composition, these are property limitations that are presumed to be inherent to the combination of Hirano et al. and Bottini, per MPEP section 2112.01, because the process for producing the silicone-containing resin of this combination is substantially identical to applicant's claims 7, 15-16. Accordingly, per MPEP section 2112, part V, the burden is shifted to the applicant to show an unobvious difference between their as-claimed invention and the combination of Hirano et al. and Bottini.

Regarding claim 10, Hirano et al. do not expressly teach or suggest that the cured silicone-containing resin is optically clear. Bottini teaches that a clear silicone resin can be used to optically couple a light emitting diode to a detector (see column 3, line 66 to column 4, line 24). Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the teachings of Hirano et al. by using an optically clear silicone resin, as taught by Bottini, in order to transmit light into or out of the sealed package disclosed by Hirano et al.

Regarding claims 11-12, the combination of Hirano et al. and Bottini lacks the specific mold temperature range as set forth in claim 11 or the injection pressure range as set forth in claim 12. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the combination of Hirano et al. and Bottini in order to use a mold temperature within the range of claim 11 and/or an injection pressure within the range of claim 12 through routine experimentation to

discover the workable ranges of the combination [see *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955)].

6. Claims 1, 4, 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano et al. (US 2002/0153618 A1) in view of Bottini (US 3,808,673) and Chaudhury et al. (US 2003/0145940 A1).

Referring to Figs. 1-10 and paragraphs [0051] to [0071], Hirano et al. disclose a semiconductor device that includes a semiconductor chip (7A) mounted onto a surface of a substrate (1) using an adhesive (9), bond wires (10) to electrically connect the chip (7A) to the substrate (1), a silicone-containing overmold resin (11) to seal the chip (7A) (see paragraph [0065]), and solder balls (12) on an opposite surface of the substrate (1). Referring to Figs. 11-13 and paragraphs [0072] to [0079], Hirano et al. further disclose that the semiconductor device can be formed by using adhesive (9) to mount the chip (7A) to a plastic film (20), connecting bond wires between the chip (7A) and the plastic film (20), placing this assembly in a mold (30) to apply the silicone-containing overmold resin (11) directly to the chip (7A), the bond wires(10), and to the plastic film (20) by injection molding, applying solder balls (12) to the opposite surface of the plastic film (20), and cutting the plastic film (20) into a substrate (1). These are limitations as set forth in claims 1, 4 of the applicant's invention.

However, Hirano et al. lack specific details regarding their injection molding process that includes heating the mold cavity (a limitation of claim 1), curing the die attach adhesive (a limitation of claim 1), using a silicone viscosity of 80 to 3000 Poise (a

limitation of claim 4), a cured over mold of the silicone composition having a modulus of 25 to 1000 MPa (a limitation of claim 4), and curing for 30 to 120 seconds at 80 to 240 degrees C (limitations of claim 4). Further, Hirano et al. lack the limitations of plasma treating a surface of the die attach adhesive, plasma treating a surface of the semiconductor die, and contacting these plasma treated surfaces with each other, which are also limitations as set forth in claim 1 of the applicant's invention.

Bottini teaches that a semiconductor device can be packaged by injection molding a silicone resin by curing for 120 to 150 seconds at a mold temperature of 190 degrees C (see column 4, lines 25-43). Chaudhury et al. teach that surfaces of an adhesive and a semiconductor can be plasma treated in order to improve adhesion between the surfaces (see paragraphs [0017] to [0034]).

Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to combine the teachings of Hirano et al. and Bottini in order to use the injection molding parameters, as taught by Bottini, for sealing the package of Hirano et al., because Bottini shows that these are known parameters for injection molding silicone resin. It also would have been obvious to further combine the teachings of Hirano et al. and Bottini with those of Chaudhury et al. in order to plasma treat the adhesive surface and chip surface for improved adherence.

Regarding the silicone viscosity and the modulus of the cured silicone composition ranges of claim 4, these are property limitations that are presumed to be inherent to the combination of Hirano et al. Bottini, and Chaudhury et al., per MPEP section 2112.01, because the process for producing the silicone-containing resin of this

combination is substantially identical to applicant's claims 1, 4. Accordingly, per MPEP section 2112, part V, the burden is shifted to the applicant to show an unobvious difference between their as-claimed invention and the combination of Hirano et al., Bottini, and Chaudhury et al.

Regarding claim 19, the cure speed and temperature ranges of 30 to 60 seconds at 80 to 150 degrees C are outside of the ranges taught by Bottini. It would have been obvious to a person of ordinary skill in the art at the time the invention was made to further modify the combination of Hirano et al., Bottini, and Chaudhury et al. in order to use cure speed and temperature ranges required by claim 19 through routine experimentation to discover the workable ranges of the combination [see *In re Aller*, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955)].

7. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano et al. (US 2002/0153618 A1), Bottini (US 3,808,673), and Chaudhury et al. (US 2003/0145940 A1) as applied to claim 1 above, and further in view of Takeuchi et al. (US 6,475,629 B1).

As shown above, the combination of Hirano et al., Bottini, and Chaudhury et al. has all of the limitations as set forth in claim 1 of the applicant's invention. However, this combination does not expressly teach or suggest that the die attach adhesive includes silicone, which is the further limitation to claim 1 as set forth in claim 2 of the applicant's invention. Takeuchi et al. teach that a die attach adhesive (4) can include a siloxane-based resin (see Fig. 5 and column 14, line 54 to column 15, line 6).

Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to combine the teachings of Hirano et al., Bottini, Chaudhury et al., and Takeuchi et al. in order to include silicone material in the die attach adhesive like the siloxane resin of Takeuchi et al., because Takeuchi et al. recognize that the siloxane resin exhibits strong adhesion (see column 25, lines 46-54).

8. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano et al. (US 2002/0153618 A1), Bottini (US 3,808,673), and Chaudhury et al. (US 2003/0145940 A1) as applied to claim 1 above, and further in view of Shimizu et al. (US 4,722,968).

As shown above, the combination of Hirano et al., Bottini, and Chaudhury et al. has all of the limitations as set forth in claim 1 of the applicant's invention. However, this combination does not expressly teach or suggest that the curable liquid includes an addition reaction curable liquid silicone composition, which is the further limitation to claim 1 as set forth in claim 18 of the applicant's invention. Shimizu et al. teach that addition reaction curable liquid silicone compositions are known in the art (see column 1, lines 15-28).

Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to further modify the combination of Hirano et al., Bottini, and Chaudhury et al. in order to use an addition reaction curable liquid silicone composition, as taught by Shimizu et al., because Shimizu et al. recognize that such

silicone compositions can advantageously be rapidly cured and they also have excellent mechanical strength (see column 1, lines 26-28).

9. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano et al. (US 2002/0153618 A1), Bottini (US 3,808,673), and Chaudhury et al. (US 2003/0145940 A1) as applied to claim 1 above, and further in view of Fishley et al. (US 6,654,248 B1).

As shown above, the combination of Hirano et al., Bottini, and Chaudhury et al. has all of the limitations as set forth in claim 1 of the applicant's invention. However, this combination does not expressly teach or suggest that the mold has a gate configured to introduce the curable liquid onto a middle of a top of an assembly that includes bond wires, which is the further limitation to claim 1 as set forth in claim 20 of the applicant's invention. Fishley et al. teach that liquid molding compound (20) can be injected through a mold (24) that has a centrally located top gate (26) for encapsulating an integrated circuit (16) and bond wires (18) (see Figs. 1, 3, 4, column 3, lines 10-26, and column 4, lines 10-21, 36-43).

Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to further modify the combination of Hirano et al., Bottini, and Chaudhury et al. in order to use a mold with a centrally located top gate, as taught by Fishley et al., because Fishley et al. show that such a configuration is effective for encapsulating a wire bonded integrated circuit.

10. Claims 21, 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano et al. (US 2002/0153618 A1) and Bottini (US 3,808,673) as applied to claims 7, 15 above, respectively, and further in view of Shimizu et al. (US 4,722,968).

As shown above, the combination of Hirano et al. and Bottini has all of the limitations as set forth in claims 7, 15 of the applicant's invention. However, this combination does not expressly teach or suggest that the curable liquid includes an addition reaction curable liquid silicone composition, which is the further limitation to claims 7, 15 as set forth in claims 21, 23, respectively. Shimizu et al. teach that addition reaction curable liquid silicone compositions are known in the art (see column 1, lines 15-28).

Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to further modify the combination of Hirano et al. and Bottini in order to use an addition reaction curable liquid silicone composition, as taught by Shimizu et al., because Shimizu et al. recognize that such silicone compositions can advantageously be rapidly cured and they also have excellent mechanical strength (see column 1, lines 26-28).

11. Claim 24 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hirano et al. (US 2002/0153618 A1) and Bottini (US 3,808,673) as applied to claim 15 above, and further in view of Barrow et al. (US 4,802,873).

As shown above, the combination of Hirano et al. and Bottini has all of the limitations as set forth in claim 15 of the applicant's invention. However, this

combination does not expressly teach or suggest that the mold has a gate configured to introduce the curable liquid into a side corner of a mold cavity, which is the further limitation to claim 15 as set forth in claim 24 of the applicant's invention. Barrow et al. teach that liquid silicone compound can be injected into a cavity (23) through a hole (22b) formed in a corner of a mold (18) in order to encapsulate an electroluminescent layer (see Figs. 4, 5, and column 2, line 60 to column 3, lines 10-21, 36-43).

Therefore it would have been obvious to a person of ordinary skill in the art at the time the invention was made to further modify the combination of Hirano et al. and Bottini in order to use a gate configured to introduce curable liquid at a side corner of a mold cavity, as taught by Barrow et al., because Barrow et al. show that such a configuration is effective for encapsulating electronic devices.

Allowable Subject Matter

12. Claim 17 is objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form to include all of the limitations of the base claim and any intervening claims.

13. The following is a statement of reasons for the indication of allowable subject matter: The prior art of record does not teach or suggest, in combination with the other claim limitations, a method that includes applying a silicone die attach adhesive composition to a substrate, using the adhesive to attach a semiconductor die to the

substrate, and injection molding a curable liquid comprising a silicone composition over the semiconductor die/substrate assembly, wherein the silicone die attach adhesive composition and the curable liquid have similar cure mechanisms such that groups reactive with the curable liquid are present in the die attach adhesive.

Response to Arguments

14. Applicant's arguments filed 28 April 2010 have been fully considered but they are not persuasive.

The applicant argues that Bottini is not combinable with Hirano et al. because the molding parameters taught by Bottini are not applicable to encapsulating wire bonded structures. This is not found to be persuasive because a person of ordinary skill in the art at the time the applicant's invention was made would be well aware that there are other ways to avoid the problem of wire sagging besides molding parameters, like using thicker wires, using shorter wire lengths, using stiff or rigid wires, etc. Accordingly, the above prior art combinations applied under 35 USC 103(a) do have a reasonable expectation for success, unless the applicant can show (not argue) that they do not.

Conclusion

15. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Stephen W. Smoot whose telephone number is 571-

272-1698. The examiner can normally be reached on Monday to Friday from 8:00am to 4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew C. Landau can be reached on 571-272-1731. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Stephen W Smoot/
Primary Examiner
Art Unit 2813

SWS